



Integrating IT service management requirements into the organizational management system

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ABSTRACT

IT service provider organizations that have implemented a Quality Management System (QMS) according to ISO 9001 can take advantage of all the efforts made when implementing an IT Service Management System (ITSMS). In order to facilitate the integration of these two management systems, we analyze the existing relations between the requirements of the QMS and the ITSMS. Based on these results, we provide a new Integrated Management System (IMS) which widens the scope of the ISO 9001 QMS with the specific IT service management requirements of ISO/IEC 20000-1, and present a guide to support organizations in implementing this IMS.

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1. Introduction

From the mid-nineties, many organizations in the Information Technology (IT) sector have shown their interest in deploying best practices for implementing and managing the services provided [1–3]. IT service provider organizations have opted for the implementation of standards to prove their ability to provide products that meet customer needs and increase their satisfaction. One of the generic standards most implemented is ISO 9001 [4], which defines a Quality Management System (QMS) that ensures the effectiveness and reliability of business processes of the organization. Moreover, different management systems standards to improve processes of specific knowledge areas have appeared during the last years (such as ITIL [5] and ISO/IEC 20000-1 [6] for IT service management, ISO/IEC 27001 [7] for information security management or COBIT [8] and SAS 70 [9] for the governance and auditing of enterprise IT).

Due to this recent proliferation of function-specific management systems and related standards, a need has emerged to somehow integrate them into one holistic Integrated Management System (IMS) that addresses various stakeholder requirements in an integrated manner in order to reduce wasteful redundancies and possibly generate synergy effects [10–12]. Some attempts have been made to integrate management standards, prevent the accumulation of management systems become a burden, and find the elusive “business management system”

that can serve as a common denominator for integrating all management standards within an organization [13]. However, the dynamics of the integration process are not yet fully understood and new research has yet to establish how the integration of management systems gives rise to various types of organizational improvements [11].

The idea of integrating best practices from different standards and management systems has been the subject of many studies in recent years [14–16]. There is no single valid definition for the term IMS. In many cases, the interpretation varies depending on the organization or the type of integration. Karapetrovic defines an IMS as a composite of interdependent processes that operate harmoniously, share the same pool of human, material, information, infrastructure and financial resources, and are all aimed toward the fulfillment of set goals [17]. Griffith and Bhutto define IMS as the single management system that delivers the processes of the business through modular and mutually supporting structured management functions configured around the wider needs of the organization [18]. For Pojasek, an IMS is one that combines management systems using an employee focus, a process view, and a systems approach [13]. Bernardo et al. summarize integration as a process of linking different standardized management systems into a unique management system with common resources aiming to improve stakeholders' satisfaction [19].

During the last decade, the demand for the integration of management systems was focused on the areas of quality, environmental and occupational health and safety. Several studies identifying the similarities among the ISO 9001, ISO 14001 and OHSAS 18001 management systems standards and the advantages of an integrated implementation

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of them in organizations were published [17,20–24]. Moreover, different research projects aiming to implement an IMS according to these standards have been carried out in several countries: Austria [25], China [26], Italy [27], Spain [28] and the United Kingdom [18].

In this paper we focus on the integration of IT Service Management Systems (ITSMS) standards. Nowadays, the standard most commonly used for establishing an ITSMS is ISO/IEC 20000-1:2011, which provides a full set of service management system requirements according to ITIL best practices. The service organizations which already have implemented an ISO 9001:2008 QMS and that are interested in implementing an ITSMS can reuse previous experiences, knowledge, processes and practices. From our experience with companies in our environment, most of the ITSMS implementations analyzed have been performed with a very low level of integration with existing QMS. Organizations need to be aware that an integrated implementation of management systems will impact, in the medium term, in the day to day operation of the business, resulting in a reduction of workload and duplicities and an optimization of the tasks related to the implementation and maintenance of the management systems.

In order to satisfy the demand of organizations that already have implemented an ISO 9001:2008 QMS for performing an integrated implementation of an ITSMS the research presented in this paper pursues the following goals:

- Determine the existence of standards for the integration of management systems.
- Evaluate existing initiatives for the creation of an IMS that integrates the ISO 9001:2008 QMS and the ITSMS.
- Analyze the relations between the requirements of the ITSMS and the QMS.
- Define guidelines to support organizations in the implementation of an IMS that integrates the ITSMS and the QMS.

This paper is organized as follows. In Section 2, the existing standards and guides for the integration of management systems are identified. In Section 3, the quality management system of ISO 9001:2008 and the IT service management system of ISO/IEC 20000-1:2011 are detailed. In Section 4, a systematic literature review of initiatives to integrate the ISO 9001:2008 QMS with other ITSMS is presented. Section 5 analyzes the existing relations between the requirements of both management systems and provides an integrated management system according to ISO/IEC 20000-1 and ISO 9001. Section 6 describes the guide that has been developed to support companies in the implementation of the provided IMS and how it has been evaluated in service companies. Finally, conclusions and future work are presented in Section 7.

2. Standards for management systems integration

Since the first goal of our research was to identify the existing standards addressing the integration of management systems, this section presents the standards that have been developed for this purpose during the last decade.

In 2001, ISO published a manual of good practices for management systems integration called ISO Guide 72:2001 Guidelines for the justification and development of management of system standards [29]. ISO Guide 72:2001 provides guidance

- for justifying and evaluating a project for the development of a new management system standard with a view to assessing market relevance,
- on the methodology of developing and maintaining management system standards with a view to ensuring compatibility and enhancing alignment, and
- on the terminology, structure and common elements of management system standards with a view to ensuring compatibility as well as enhancing alignment and ease of use.

ISO Guide 72:2001 categorize the common elements that any management system provides into the following five groups: policy, planning, implementation and operation, performance, and improvement and management review. ISO Guide 72:2001 has been used as the basis for multiple management systems, such as ISO 9001, ISO 14001, OHSAS 18001, ISO 22000 and ISO/IEC 27001. While each standard has its own specific requirements, these six categories are present in all cases.

Some of the countries that have made important efforts to integrate management systems are Australia/New Zealand, Spain and the United Kingdom. In Australia and New Zealand the standard AS/NZS 4581:1999 [30] provides guidance to identify the components that are common to all management systems. The standard's goal is to provide a guide for all management systems in which the common requirements of the individual systems are integrated to avoid duplication of content and thus provide a uniform basis for the characteristics of each individual system.

In Spain, AENOR published in 2005 the standard UNE 66177:2005 [31], which provides guidance for the integration of management systems. The standard consists of eight chapters and five appendices that contain guidelines to develop, implement and evaluate, through review and improvement processes, the resulting IMS. Although these guidelines allow easy integration of management systems of any nature, the standard states in the introduction that the guidance provided specifically refers to ISO 9001, ISO 14001 and OHSAS 18001, as they were the most widespread management systems at the time of publication of the standard.

In the United Kingdom, the British Standards Institution (BSI) published in 2006 the PAS 99:2006 Publicly Available Specification – Specification of common management system as a framework for Requirements integration [32]. It consists of a specification of common requirements for management systems and a framework for integration. It was developed to help organizations who were interested in implementing requirements of two or more standards in an integrated way. The structure and content of PAS 99:2006 were developed using the same pattern used for any new management system standard, which is described in ISO Guide 72:2001. PAS 99:2006 introduces a generic framework to organize in an integrated manner the common requirements of standards such as, for example, ISO 9001, ISO 14001 and OHSAS 18001, among others.

In 2008, ISO published the integrated use of management system standards [33]. This book is not a standard or specification but presents methodologies, tools and practices extracted from author's experience obtained in practical cases. It addresses some of the ISO management system standards, such as ISO 9001 for quality management, ISO 14001 for environmental management, ISO 22000 for food safety, ISO 28000 for supply chain security and ISO/IEC 27001 for information security.

3. ISO 9001 and ISO/IEC 20000-1 management systems

Since ISO 9001:2008 and ISO/IEC 20000-1:2011 are both developed, maintained and refined by the same international organization, provide their recommendations, guidelines, requirements or best practices under the same process approach, and use the same vocabulary and terms, there are a large number of relations between the management systems they define as well as many common elements. Due to these relations, we took as a reference the ITSMS defined by the ISO/IEC 20000-1:2011 standard.

This section presents the management systems of the ISO 9001:2008 and ISO/IEC 20000-1:2011 standards, describing their purpose, objectives and compatibility with other standards.

3.1. ISO 9001:2008 quality management system

ISO 9001:2008 quality management systems – requirements [4] promotes the adoption of a process approach when developing,

implementing and improving the effectiveness of a Quality Management System (QMS), to enhance customer satisfaction by meeting customer requirements. It enables an organization to align or integrate its own QMS with related management system requirements.

The standard is structured in eight clauses. The first three clauses deal with scope, application and definitions. Clauses four to eight are process-oriented and they define the requirements for implementing a QMS. All these requirements are generic and are intended to be applicable to all organizations, regardless of type, size and product provided.

ISO 9001:2008 is based on the PDCA (Plan–Do–Check–Act) cycle, also known as the Deming cycle. PDCA is an iterative four-step management method used in business for the control and continuous improvement of processes and products. The PDCA cycle is the operating principle of the majority of ISO management systems.

3.2. ISO/IEC 20000-1:2011 IT service management system

ISO/IEC 20000-1:2011 Information technology – service management – Part 1: Service management system requirements [6] specifies requirements for the service provider to plan, establish, implement, operate, monitor, review, maintain and improve an IT Service Management System (ITSMS). These requirements include the design, transition, delivery and improvement of services to fulfill agreed service requirements and provide value for both the customer and the service provider.

ISO/IEC 20000-1:2011 is also based on the PDCA cycle and was originally developed to reflect best practice guidance contained within ITIL [5], although it equally supports other IT service management frameworks and approaches, including some components of COBIT [8].

ITIL was developed by the U.K. Office of Government Commerce in the late 1980s to provide guidance on what should be done in order to offer users adequate IT services to support their business processes. ITIL qualifications are available for individuals but until recently there was no way for an IT organization to prove that it is working along the ITIL recommendations. The ISO/IEC 20000:2011 standard was conceived to fill this gap. It is modeled upon the principles of ITIL and allows IT organizations to have their ITSMS certified. In contrast to ITIL, ISO/IEC 20000-1:2011 does not offer specific advice on how to design processes. It is rather a set of requirements which must be met in order to qualify for certification.

ISO/IEC 20000-1:2011 is structured in nine clauses. As ISO 9001, the first three clauses deal with scope, application and definitions. Clause four defines the general requirements of an ITSMS. Clause five defines the requirements for the design and transition of new or changed services. Clauses six to nine are process-oriented and define the service delivery, control, resolution and relationship processes.

Table 1 shows the correspondence between ISO/IEC 20000-1:2011 sections and ITIL 2011 processes. As ITIL focuses on the life cycle of services, but offers less guidance on establishing and operating the ITSMS itself, it is at times not straightforward to map ITIL and ISO/IEC 20000-1:2011, especially Sections 4 and 5. In those cases (marked with an asterisk), various ITIL processes together can be used to fulfill the requirements.

4. Systematic literature review of management systems integration initiatives

This section presents a systematic literature review of all the existing initiatives to integrate the QMS and the ITSMS. The research is undertaken following the guidelines proposed by Kitchenham [34,35] and the review protocol template developed by [36] which describes each phase of the systematic review process in terms of template sections. The protocol used for the systematic review is composed of five different stages: Question Formularization, Selection of Sources, Selection of Studies, Information Extraction and Results Summarization. These five stages are detailed in the next sections.

Table 1

Correspondence between ISO/IEC 20000-1:2011 sections and ITIL processes.

ISO/IEC 20000-1:2011 chapter	Correspondence with ITIL
<i>4 Service management system general requirements</i>	
4.1 Management responsibility	Strategy management for IT services Continual service improvement*
4.2 Governance of processes operated by other parties	Supplier management Service level management
4.3 Documentation management	Service strategy* Service design* Service transition*
4.4 Resource management	Strategy management for IT services Service design* Service operation* Continual service improvement*
4.5 Establish and improve the SMS	Service strategy* Service design* and Continual service improvement*
4.5.1 Define scope	
4.5.2 Plan the SMS (Plan)	
4.5.3 Implement and operate the SMS (Do)	
4.5.4 Monitor and review the SMS (Check)	
4.5.5 Maintain and improve the SMS (Act)	
<i>5 Design and transition of new or changed services</i>	
5.1 General	Design coordination Service transition*
5.2 Plan new or changed services	Service strategy* Service design* Service transition*
5.3 Design and development of new or changed services	Service design* Service transition*
5.4 Transition of new or changed services	Service transition*
<i>6 Service delivery processes</i>	
6.1 Service level management	Service level management
6.2 Service reporting	Service level management
6.3 Service continuity and availability management	IT service continuity management and Availability management
6.3.1 Service continuity and availability requirements	
6.3.2 Service continuity and availability plans	
6.3.3 Service continuity and availability monitoring and testing	
6.4 Budgeting and accounting for IT Services	Financial management for IT services
6.5 Capacity management	Capacity management
6.6 Information security management	Information security management
6.6.1 Information security policy	
6.6.2 Information security controls	
6.6.3 Information security changes and incidents	
<i>7 Relationship processes</i>	
7.1 Business relationship management	Business relationship management
7.2 Supplier management	Supplier management
<i>8 Resolution processes</i>	
8.1 Incident and service request management	Incident management and request fulfillment
8.2 Problem management	Problem management
<i>9 Control processes</i>	
9.1 Configuration management	Service asset and configuration management
9.2 Change management	Change management
9.3 Release and deployment management	Release and deployment management

4.1. Question formularization

During the first stage, the research objectives and the necessary steps to carry it out are defined. With the aim of defining the context in which

the systematic review is applied, the protocol suggests to specify a set of items. In our particular case, each item has been defined specifically for identifying studies dealing with the integration of the ISO 9001 quality management system and the IT service management system.

- **Problem:** The organizations that have implemented the ISO 9001 standard and want to implement an IT service management system must meet certain requirements that have already partially or fully implemented, which implies a task repetition.
- **Question:** What initiatives based on integrating ISO 9001 and ISO/IEC 20000-1 management systems exist?
- **Keywords and synonyms:** ISO 9001, Quality Management System (QMS), ISO/IEC 20000-1, ISO 20000, ITIL, IT Service Management System (ITSMS), Integrated Management System (IMS).
- **Intervention:** Analyze existing integrated management systems covering the requirements of the ISO 9001 QMS and an ITSMS.
- **Control:** There are no initial data for this systematic review.
- **Effect:** Identify all the initiatives, frameworks and models defining an IMS according to the requirements of ISO 9001 and an IT service management system.
- **Outcome measure:** The number of identified studies, initiatives and IMS models.
- **Population:** The set of research proposals and papers related to IMS according to ISO 9001 and ITIL or ISO/IEC 20000-1 which have been published in the list of sources selected for conducting the systematic review.
- **Application:** Organizations of all types and sizes which have implemented the ISO 9001 QMS and are interested in minimizing the implementation efforts to adopt the ITSMS. Researchers working on quality models or on IT service management.
- **Experimental design:** None statistical analysis methods will be applied.

4.2. Selection of sources

To perform the selection of the sources where searches for primary studies will be executed, the systematic review protocol proposes to address the following issues: definition of source selection criteria and identification of sources, selection of the language of the studies, and definition of search strings.

With regard to source selection criteria, the following criteria have been defined: publishing companies or websites suggested by experts, high-impact publications, availability of search mechanisms using keywords, non-variability in search results by using the same set of keywords and availability on the Web. The sources have been identified on the basis of the judgment of the authors of this paper. Taking into account the defined sources selection criteria the list of selected sources is shown in Table 2. This list of sources includes relevant journals in which quality management and IT service management research areas are widely dealt with.

Concerning language studies, the obtained primary studies must be written in English or Spanish.

Table 2
List of sources.

Source	Name	Web site
1	ACM Portal (Digital Library & Guide)	http://portal.acm.org/portal.cfm
2	CiteSeerX	http://citeseerx.ist.psu.edu
3	Google Scholar	http://scholar.google.com
4	IEEE Computer Society Digital Library	http://www.computer.org/portal/web/csdli
5	IEEE Xplore	http://ieeexplore.ieee.org
6	IET Digital Library	http://www.ietdl.org
7	SAGE Journals	http://online.sagepub.com/
8	ScienceDirect	http://www.sciencedirect.com
9	Springer Link	http://www.springerlink.com
10	Wiley InterScience	http://www.interscience.wiley.com

By taking the list of keywords defined in Section 4.1 and making combinations with the logical operators “AND” and “OR”, the search strings shown in Table 3 have been obtained. To carry out the searches, these search strings need to be adapted to each of the search engines of the selected sources.

4.3. Selection of studies

Once the sources are defined, it is necessary to describe the process and the criteria for studies selection and evaluation. The criteria by which studies will be evaluated to decide if they must be selected or excluded in the context of the systematic review were defined by the authors of the paper taking into account Kitchenham's proposals. These criteria, Inclusion Criteria (IC) and Exclusion Criteria (EC), are shown in Table 4.

The process performed to obtain and evaluate primary studies according to the defined inclusion and exclusion criteria is illustrated as a flow diagram in Fig. 1. This flow diagram shows two main groups of activities. The goal of the first group is the selection of primary studies. The second group of activities aims to extract the information of the selected primary studies. Information extraction will be presented later in Section 4.4.

With regard to the selection of primary studies, the analysis of the title and the keywords will be the main inclusion criteria. In case this information is not enough to decide about the inclusion or the exclusion of the study then the abstract will be also analyzed and the full text, if necessary. Initially all types of primary studies related to the definition or application of an integrated management system will be taken into account. More concretely, the focus will be on studies presenting an IMS covering the requirements of ISO 9001 and ITIL or ISO/IEC 20000-1.

Table 5 shows the distribution of the studies obtained from each search source. As a result of the search execution 1244 studies were obtained for further evaluation. Table 5 shows the number of initial studies obtained from each source (see the column “Discovered”).

After applying the inclusion criteria IC1, IC2, IC3 and IC4, defined in Table 4, only 96 of the 1244 discovered articles were considered as relevant articles. Applying the criterion EC2 for the exclusion of duplicated articles, only 61 articles were obtained. From these, applying the criterion EC1, finally only 4 articles were selected as primary studies. These results are shown in the last row of Table 5. The complete list of selected primary studies is presented in Table 6. This primary study selection has been reviewed by the authors in order to guarantee the quality of the included studies.

4.4. Information extraction

Once primary studies are selected, the extraction of relevant information begins. The criteria by which the information obtained from the studies should be included were defined. These information inclusion criteria (IC_{inf}) are presented in Table 7.

To analyze the data obtained from the selected primary studies and to standardize the way in which information should be registered, an information extraction form was designed in order to meet our particular research goals. This form was used to record comments, impressions and the most important ideas from each primary study. The structure and contents of this form are based on the information extraction

Table 3
Search strings.

Search strings
1 ((“ISO 9001” or (“ITIL” or “ISO 20000”)) and (“IMS” or “integrated management system”))
2 ((“QMS” or “quality management system”) and (“ITSMS” or “SMS” or “service management system”) and (“IMS” or “integrated”))

Table 4
Definition of studies inclusion and exclusion criteria.

Criterion	Description
IC1	Include papers whose title is related to the integration of the ISO 9001 quality management system and an IT service management system
IC2	Include papers that contain keywords that match with those defined in the search strings
IC3	Include papers whose abstract is related to the topic under consideration
IC4	Include papers that contain information related to the definition or application of an integrated management system
EC1	Exclude those papers that refer to the ISO 9001 QMS and to the ITIL or ISO/IEC 20000-1 ITSMS separately, without showing any kind of relationship between both management systems or between their requirements
EC2	Exclude all duplicated papers

format proposed in Ref. [41]. Table 8 shows, for each primary study, the content of the conclusions field of the information extraction form.

4.5. Results summarization

The last stage of the systematic review protocol aims to present the data and conclusions resulting from the selected primary studies. After

the systematic review execution, 1244 studies were discovered and 4 of them were considered primary studies.

The obtained results show the trend in recent years to integrate different management systems. The obtained primary studies identify and determine the main reasons for integration and define frameworks and guidelines in very abstract terms. These models provided are defined at a very high level, using a theoretical perspective. None of them provide specific and concrete operational procedures that can be useful for organizations to implement an IMS according to ISO 9001 and ITIL or ISO/IEC 20000-1.

Since integration must be performed at the level of processes and requirements, the analysis of the requirements of the management systems to be integrated is a key factor for a successful integration. The selected primary studies do not directly address the requirements of the two management systems to be integrated.

In conclusion, primary studies resulting from the systematic review process cannot be used as a starting point to meet the goal set by this research project.

5. ISO 9001 and ISO/IEC 20000-1 integrated management system

This section describes the IMS obtained from the relations between the requirements of the ISO 9001:2008 QMS and ISO/IEC 20000-1:2011 ITSMS.

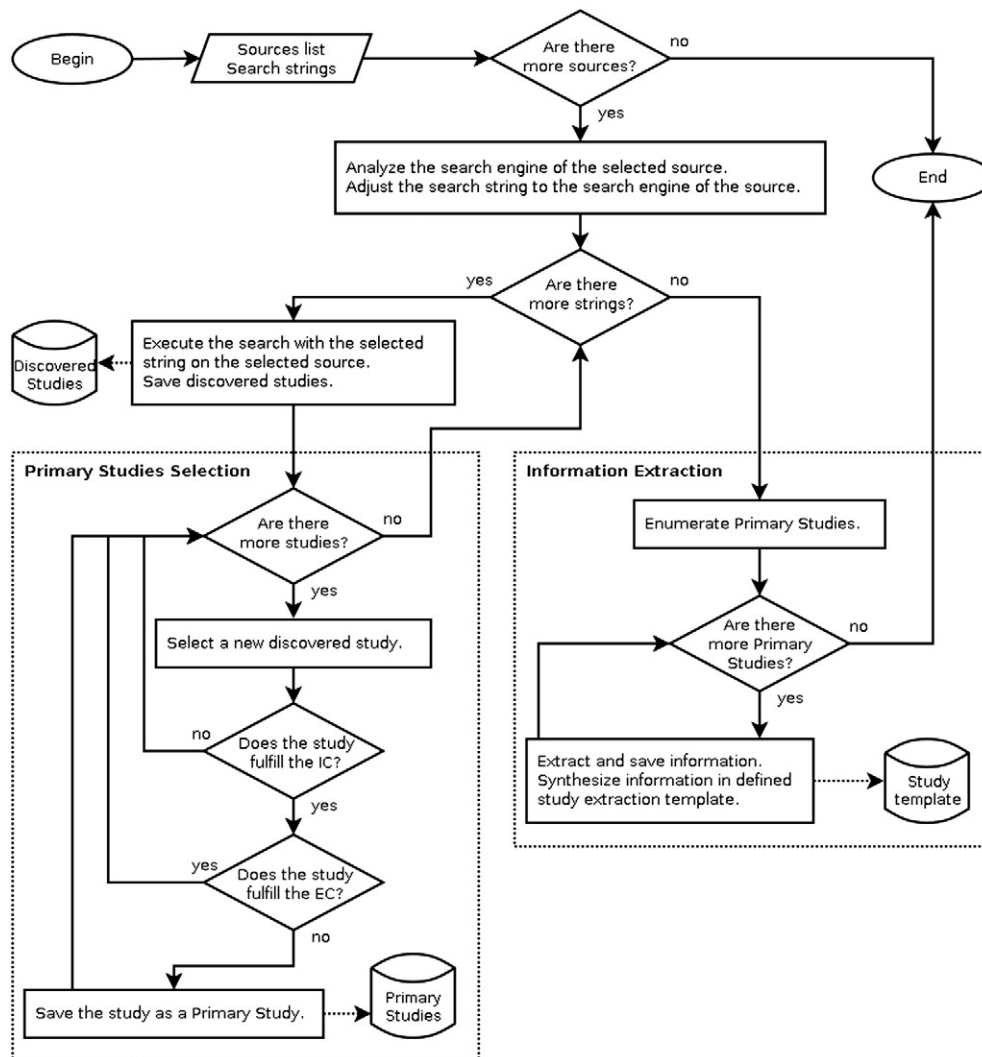


Fig. 1. Procedure for executing the systematic review.

Table 5
Distribution of studies by source.

Source	Search date	Discovered	Relevant	Not repeated	Primarys
ACM Portal (Digital Library & Guide)	2013/08/26	41	2	1	0
CiteSeerX	2013/08/26	30	11	9	0
Google Scholar	2013/08/27	1023	42	19	3
IEEE Computer Society Digital Library	2013/08/26	10	4	4	0
IEEE Xplore	2013/08/26	39	10	9	1
IET Digital Library	2013/08/28	5	1	0	0
SAGE Journals	2013/08/28	1	0	0	0
ScienceDirect	2013/08/29	33	7	5	0
Springer Link	2013/08/30	17	7	5	0
Wiley InterScience	2013/08/30	45	12	9	0
Total		1244	96	61	4

5.1. Research method

The first step of the research consisted on the study of the two standards in order to observe if the management systems they define could be integrated. Both standards explicitly refer to the compatibility with other management systems. ISO 9001 does not include requirements specific to other management systems but enables an organization to align or integrate its own QMS with related management system requirements. ISO/IEC 20000-1 enables a service provider to integrate its ITSMS with other management systems in the service provider's organization. The adoption of an integrated process approach and the PDCA methodology enables the service provider to align or fully integrate multiple management system standards. Therefore, we corroborated that the ISO/IEC 20000-1 ITSMS could be integrated with the ISO 9001 QMS.

The research followed an integration iterative strategy called integration by conversion, which allows any organization to reduce the human resources, budget and time necessary for planning, implementing and maintaining a new management system [12,17]. This type of integration takes as a base the existing management system and expands it with the elements or requirements of the new management system to be integrated. In our research, the relations and connections between each ISO/IEC 20000-1 ITSMS requirement and the ISO 9001 QMS requirements were thoroughly examined. The final version of the mapping between the two standards is the result of a successive refinement process performed in three stages as shown in Fig. 2.

- With the objective of sharing the knowledge and the different points of view among the authors, during the first stage (joint analysis) both standards were analyzed by the authors in group. Since it was not possible to perform a complete mapping in only one session, different meetings were necessary in order to obtain a first preliminary version of the mapping. During each meeting two or three ISO/IEC 20000-1 clauses were analyzed. More specifically, taking into account that each clause is composed of different requirements, for each requirement its description was analyzed in depth. It should be noted that the authors' knowledge of the ISO 9001 standard facilitated the initial selection of the set of clauses related to the requirement under consideration. After a detailed analysis of the requirements of

the ISO 9001 selected clauses, it was possible to determine the existence or not of a connection between the ISO/IEC 20000-1 requirement and a particular ISO 9001 requirement.

- During the second stage, with the intention of consolidating the results obtained after the meetings, these results were individually re-examined by each author to confirm the decisions reached or, on the contrary, to make some modifications to the initial version of the mapping.
- Finally, during the joint review stage the individual proposals of each author were carefully discussed in order to reach a general consensus to accept or reject each proposal.

To ensure good traceability between standards, this iterative strategy was also performed in the opposite direction, that is, comparing the ISO 9001 QMS requirements with the ISO/IEC 20000-1 ITSMS requirements, not only in terms of requirements, but also conceptually.

5.2. Analysis of the relations between ISO 9001 and ISO/IEC 20000-1 management systems

After conducting a thorough analysis of all the requirements of both management systems three different types of relations were identified:

- Full relation (F). The ISO/IEC 20000-1 requirement is already covered by the requirements of the ISO 9001 QMS. In this case, any specific aspect concerning IT service management should not be added to the implemented QMS when defining the new IMS. An example of this kind of relation can be found in clause 4.3.1 *Establish and maintain documents* of ISO/IEC 20000-1:2011, which states "The service provider shall establish and maintain documents, including records, to ensure effective planning, operation and control of the SMS". However, this requirement is already covered by ISO 9001:2008 in its clause 4.2.1 *General d*) "The quality management system documentation shall include documents, including records, determined by the organization to be necessary to ensure the effective planning, operation and control of its processes".
- Partial relation (P). The ISO/IEC 20000-1 requirement expands some of the ISO 9001 QMS requirements with particular aspects of IT service management. An example of this kind of relation is the case of requirements related to management commitment, which are defined in clause 5.1 *Management commitment* of ISO 9001:2008.

Table 6
List of primary studies in the systematic review.

Primary study	Authors
1 Integrated management systems — requirement of contemporary business practices [37]	Mirko Djapic and Ljubomir Lukic
2 Integrated information management systems — security and protection of information [38]	Ludek Novák
3 Integrated installing ISO 9000 and ISO 27000 management systems on an organization [39]	Chi-Hsiang Wang and Dwen-Ren Tsai
4 The development of business standardization and integrated management systems [40]	Vidosav D. Majstorovic and Valentina Marinkovic

Table 7
Definition of information inclusion criteria.

Criterion	Description
IC1 _{inf}	Identify existent Integrated Management Systems (IMS) initiatives
IC2 _{inf}	Identify methodologies, techniques, methods and procedures for IMS implementation and maintenance
IC3 _{inf}	Collect information about the relationships between the requirements of the management systems that are integrated

Table 8
Conclusions extracted from primary studies.

Primary study	Conclusions field of the information extraction form
Integrated management systems – requirement of contemporary business practices [37]	This paper provides an approach to the integration of different standard requirements, based on the interrelation of mutually connected business processes. Integration of several systems into one is more efficient and economical than developing and implementing separate systems. The paper presents and explains several key definitions related to integration aspects. Orientation toward business processes is the key to integration.
Integrated information management systems – security and protection of information [38]	This paper tries to find consensus in three different types of the management systems: the quality management system, the IT service management system and the information security management system. An aim is to compose a complex framework based on advantages and synergies. Author's experience with integrations of the three types of the management systems into one consistent information management framework is described. The integration is based on similarities of the management systems especially on the PDCA Model, which is a key shared principle. The second principle is an effort to incorporate information risks into each type of systems.
Integrated installing ISO 9000 and ISO 27000 management systems on an organization [39]	In this paper, an integrated management system model suitable for ISO 9001, ISO 27001 and other PDCA based implementations is built. This integrated system model may facilitate the management efficiency of organizations complied with multiple PDCA based management systems. This integrated research work intends to realize the PDCA cyclic management mechanism for integrated ISO management systems.
The Development of Business Standardization and Integrated Management Systems [40]	The basic question that is arisen in this paper is how to apply ISO standards in an integrated fashion. This paper deals with the development of individual models of business standardization, and their integration in the design and implementation of IMS, from the viewpoint of quality management requirements, environmental protection, the safety and health protection of employees and some other demands.

“Top management shall provide evidence of its commitment to the development and implementation of the quality management system and continually improving its effectiveness by a) communicating to the organization the importance of meeting customer as well as statutory and regulatory requirements, b) establishing the quality policy, c) ensuring that quality objectives are established, d) conducting management reviews, and e) ensuring the availability of resources”. In this case, this ISO 9001 QMS requirement should be extended with specific aspects of IT service management, detailed in clauses 4.1.1 *Management commitment* b), c) and g) of ISO/IEC 20000-1:2011: “Top management shall provide evidence of its commitment to planning, establishing, implementing, operating, monitoring, reviewing, maintaining, and improving the SMS and services by: b) ensuring that the service management plan is created, implemented and maintained in order to adhere to the policy, achieve the objectives for service management and fulfill the service requirements; c) communicating the importance of fulfilling service requirements; and g) ensuring that risks to services are assessed and managed”.

- Nonexistence of relation (‘ ’). When ISO/IEC 20000-1 adds new requirements specific to IT service management not covered by the ISO 9001 QMS. An example of this kind of relation can be found in clauses 4.5.1 to 4.5.5 of ISO/IEC 20000-1:2011 (4.5.1 *Define scope*, 4.5.2 *Plan the SMS (Plan)*, 4.5.3 *Implement and operate the SMS (Do)*, 4.5.4 *Monitor and review the SMS (Check)* and 4.5.5 *Maintain and improve the SMS (Act)*) which detail the actions needed to establish an ITSMS and extend with specific aspects and issues of IT service management the definitions of the four stages of the PDCA cycle.

5.3. ISO 9001 and ISO/IEC 20000-1 integrated management system

Table 9 shows the ISO 9001 and ISO/IEC 20000-1 IMS. The first column contains all the clauses of ISO 9001 requirements. The values defined in the second column, type of relation, represent the existing relation with the ITSMS requirements of ISO/IEC 20000-1, as shown in the third column. These values are indicative, since not all organizations give the same importance or weight to the same requirements within

their custom management systems. It has to be noted that the standards defining management systems specify what should be met, but not how.

An organization with an ISO 9001 QMS wishing to implement the ISO/IEC 20000-1 ITSMS will have to widen the scope of the existing QMS by considering the requirements of ISO 20000 partially (P) related and integrate all the other applicable ITSMS requirements that do not appear on the third column of the table. As a result, the organization will have implemented an IMS with a substantial reduction of duplicities and inconsistencies and an important saving of effort and resources at the time of implementation.

6. Guide to support the implementation of an integrated IT service management system

The final result of the conducted research has been a guide to support organizations in effectively implementing an ISO/IEC 20000-1 ITSMS integrated with the existing ISO 9001 QMS. This guide is named “IT Service Management – Guidelines for the implementation of ISO/IEC 20000-1:2011 from ISO 9001:2008”.

The guide follows the philosophy and structure used by the ISO when providing guidance for organizations in the application of ISO 9001, such as ISO/IEC 90003:2004 Software engineering – Guidelines for the application of ISO 9001:2000 to computer software [42] and ISO/IEC TR 90005:2008 Systems engineering – Guidelines for the application of ISO 9001 to system life cycle processes [43]. These two documents provide guidance for organizations in the application of ISO 9001:2000 to the acquisition, supply, development, operation and maintenance of computer software and systems, respectively.

In 2008, ISO initiated a new project called ISO/IEC NP 90006 Information technology – Guidelines for the application of ISO 9001:2000 to IT service management [44] to develop a guide for the application of ISO 9001 to IT service management. However, some years after, this standard is still under development.

For each ISO 9001:2008 requirement the guide provides:

- The title and content of the ISO/IEC 9001:2008 clause,
- The type of relation with ISO/IEC 20000-1:2011,
- A detailed explanation of the ITSMS requirements to be added to the QMS requirements already implemented within the organization and
- The text of the related ISO/IEC 20000-1:2011 requirement/s. This information is shown only in the case of a partial relation.

It has to be noted that, even being the most important result of the research performed, the guide is not presented because of its extension (49 pages). However, with the aim of illustrating the usage of the guide, Fig. 3 shows an excerpt for a particular ISO 9001 requirement. In order

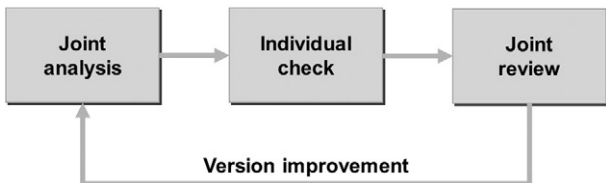


Fig. 2. The mapping process flow.

Table 9

ISO 9001:2008 and ISO/IEC 20000-1:2011 integrated management system.

ISO 9001:2008	Type of relation			ISO/IEC 20000-1:2011
Introduction	0			
General	0.1			
Process approach	0.2	P	4.5	Establish and improve the SMS
Relationship with ISO 9004	0.3			
Compatibility with other management systems	0.4			
Scope	1	P	1	Scope
General	1.1	P	1.1	General
Application	1.2	P	1.2	Application
Normative references	2			
Terms and definitions	3			
Quality management system	4			
General requirements	4.1			
Documentation requirements	4.2	P	4.3	Documentation management
General	4.2.1	P	4.3.1	Establish and maintain documents
Quality manual	4.2.2	P	4.3.1	Establish and maintain documents
Control of documents	4.2.3	P	4.3.2	Control of documents
Control of records	4.2.4	P	4.3.3	Control of records
Management responsibility	5			
Management commitment	5.1	P	4.1.1	Management responsibility
Customer focus	5.2	F	4.1.1	Management commitment
Quality policy	5.3	P	4.1.2	Service management policy
Planning	5.4			
Quality objectives	5.4.1	P	4.5.2	Plan the SMS (Plan)
Quality management system planning	5.4.2	P	4.5.2	Plan the SMS (Plan)
Responsibility, authority and communication	5.5			
Responsibility and authority	5.5.1	P	4.1.3	Authority, responsibility and communication
Management representative	5.5.2	F	4.1.4	Management representative
Internal communication	5.5.3			
Management review	5.6			
General	5.6.1			
Review input	5.6.2			
Review output	5.6.3			
Resource management	6	P	4.4	Resource management
Provision of resources	6.1	F	4.4.1	Provision of resources
Human resources	6.2	P	4.4.2	Human resources
General	6.2.1	P	4.4.2	Human resources
Competence, training and awareness	6.2.2	P	4.4.2	Human resources
Infrastructure	6.3			
Work environment	6.4			
Product realization	7			
Planning of product realization	7.1			
Customer-related processes	7.2			
Determination of requirements related to the product	7.2.1			
Review of requirements related to the product	7.2.2			
Customer communication	7.2.3			
Design and development	7.3	P	5	Design and transition of new or changed services
Design and development planning	7.3.1			
Design and development inputs	7.3.2			
Design and development outputs	7.3.3			
Design and development review	7.3.4			
Design and development verification	7.3.5			
Design and development validation	7.3.6			
Control of design and development changes	7.3.7			
Purchasing	7.4			
Purchasing process	7.4.1			
Purchasing information	7.4.2			
Verification of purchased product	7.4.3			
Production and service provision	7.5	P	4.5.3	Implement and operate the SMS (Do)
Control of production and service provision	7.5.1			
Validation of processes for production and service provision	7.5.2			
Identification and traceability	7.5.3			
Customer property	7.5.4			
Preservation of product	7.5.5			
Control of monitoring and measuring equipment	7.6			
Measurement, analysis and improvement	8			
General	8.1			
Monitoring and measurement	8.2			
Customer satisfaction	8.2.1			
Internal audit	8.2.2	P	4.5.4	Monitor and review the SMS (Check)
Monitoring and measurement of processes	8.2.3	P	4.5.4	Monitor and review the SMS (Check)
Monitoring and measurement of product	8.2.4			
Control of nonconforming product	8.3			
Analysis of data	8.4			
Improvement	8.5	P	4.5.5	Maintain and improve the SMS (Act)

(continued on next page)

Table 9 (continued)

ISO 9001:2008	Type of relation			ISO/IEC 20000-1:2011
Continual improvement	8.5.1	P	4.5.5	Maintain and improve the SMS (Act)
Corrective action	8.5.2			
Preventive action	8.5.3			

IT Service Management – Guidelines for the implementation of ISO/IEC 20000-1:2011 from ISO 9001:2008

5 MANAGEMENT RESPONSIBILITY

ISO 9001:2008 Quality management systems – Requirements

5.1 Management commitment

Top management shall provide evidence of its commitment to the development and implementation of the quality management system and continually improving its effectiveness by

- a) communicating to the organization the importance of meeting customer as well as statutory and regulatory requirements,
- b) establishing the quality policy,
- c) ensuring that quality objectives are established,
- d) conducting management reviews, and
- e) ensuring the availability of resources.

Relation

Partial relation. There are some ISO/IEC 20000-1 IT service management system requirements that expand the ISO 9001 quality management system requirements.

Comments

Three new requirements (4.1.1.b, 4.1.1.c and 4.1.1.g) should be added to the ISO 9001 Management commitment requirements in order to enable an effective implementation and management of all IT services. The first one ensures that the service management plan adheres to the policy, achieve the objectives for service management and fulfil the service requirements. The second requirement is related to the communication of the importance of fulfilling service requirements. The last one ensures that service management risks are assessed and managed.

Text of the ISO/IEC 20000-1:2011 related requirement/s

4 SERVICE MANAGEMENT SYSTEM GENERAL REQUIREMENTS

4.1 Management responsibility

4.1.1 Management commitment

Top management shall provide evidence of its commitment to planning, establishing, implementing, operating, monitoring, reviewing, maintaining, and improving the SMS and services by:

- b) ensuring that the service management plan is created, implemented and maintained in order to adhere to the policy, achieve the objectives for service management and fulfil the service requirements;*
- c) communicating the importance of fulfilling service requirements;*
- g) ensuring that risks to services are assessed and managed.*

Table 10
Characteristics of interviewed organizations.

Case	Interviewee role	Size	Core business	Client sector	ITIL	QMS	Location
A	IT manager	Medium	IT services	Tourism	V3	ISO 9001 EFQM	Spain
B	IT manager	Medium	IT services	Tourism	V3	ISO 9001	Spain
C	IT manager	Medium	Software solutions	Tourism	–	–	Spain
D	IT manager	Medium	Public administration	Society	–	ISO 9001	Spain
E	IT manager	Medium	Health service	Society	–	ISO 9001	Spain

to improve the comprehension of the work done, we have selected as an example the requirements of clause 5.1 *Management commitment* of ISO 9001, whose relations have already been discussed in Section 5.2.

In order to complete the IMS, the guide also lists the ISO/IEC 20000-1 ITSM requirements which are not related to any requirement of the ISO 9001 QMS, and should be implemented as indicated in the ISO/IEC 20000-1 standard.

6.1. Application of the guide

The guide to support the implementation of an integrated ITSMS has a double application. It could be used, on the one hand:

- To facilitate the implementation of the ISO/IEC 20000-1 standard in organizations which are or have been involved in a quality initiative according to ISO 9001 or, on the other hand,
- To facilitate the simultaneous implementation of both ISO/IEC 20000-1 and ISO 9001 standards, avoiding the repetition of similar tasks included in both standards, and therefore, reducing the amount of effort required by the organization.

In both cases, for each of the ISO/IEC 20000-1 ITSMS requirements, the guide proposes a set of actions on the ISO 9001 quality management system to meet the IT service management issues of the related requirements.

6.2. Evaluation of the guide in service companies

The guide was evaluated using semi-structured face-to-face interviews in five different organizations. Table 10 provides an overview of the interviewed organizations. To maintain confidentiality, the organizations are referred to as Case A to D.

The respondents in the five organizations were the managers of the IT departments. Based on the categorization of the European Commission [45], all companies are medium-sized (50–249 staff). Three interviewed

organizations have significant links with the tourism sector, as they all provide IT services to the tourism industry. Tourism is a service-intensive industry that is dependent on the quality of customers' service experiences and consumption occurs in interaction with the suppliers of those services [46,47]. Case D is a local public administration that provides services primarily in the environment, welfare facilities and urbanism sectors. Case E is a hospital center that provides health services to its customers.

All the interviewed organizations have a strong commitment to quality and were chosen by the researchers for the guide evaluation because they have conducted process improvement initiatives in various knowledge areas at different organizational levels. Two of the three interviewed organizations use ITIL as a reference framework (A, B). Four of the interviewed organizations are certified to the ISO 9001 quality management system (A, B, D, E) and the EFQM Excellence Model is followed in Case A.

As four companies (A, B, D, E) had already got the ISO 9001 certification, they applied the guide in order to validate its usefulness, completeness, and suitability when integrating the ISO/IEC 20000-1 ITSMS requirements. They used the guide to identify and validate the ISO/IEC 20000-1 ITSMS requirements which could be deployed on each of the ISO 9001 QMS established in the organization. In addition, the companies were able to observe that there existed other ITSMS requirements not covered so far that could be easily deployed on the existent QMS.

Case C applied the guide to initiate the simultaneous implementation of both ISO/IEC 20000-1 and ISO 9001 management systems. As the quality responsible was not familiar with the terms and definitions used by both standards, we supported the company to interpret all confusing issues, to take agreed solutions and adopt them at all organizational levels. Case C will soon be formally audited to get the ISO/IEC 20000-1 certification.

Table 11 summarizes the answers collected in the case organizations as reported in the interviews. In the first column the table lists the requirements of both ISO 9001 and ISO/IEC 20000-1 management

Table 11
Summary of the results obtained from the interviewed organizations.

Case	Requirements of both ISO 9001 and ISO/IEC 20000-1 management systems most easily integrated	Major advantages of integration	Impact of the IMS on IT service quality
A	Documentation management Monitoring, measurement and internal audits Human resources competence, training and awareness The definition of corrective and preventive actions	Increased efficiency Optimal use of resources Better matching stakeholder interests	Customer satisfaction IT service quality/stability Certification of the organization
B	Documentation management Monitoring, measurement and internal audits Management responsibility and commitment	Standardization Minimizing problems with communication between different areas	Customer satisfaction Better alignment of people and information Certification of the organization
C	–	Possibility to link quality related and IT service management related aspects with ethics and organizational profitability	Customer satisfaction Facilitation of growth of the organization Certification of the organization
D	Documentation management Human resources competence, training and awareness Provision of resources	Effective support of processes Efficient monitoring of stakeholder aspects	Customer satisfaction IT service quality/stability Better alignment of people and information
E	Documentation management Monitoring, measurement and internal audits Management responsibility and commitment	Consolidation of the PDCA approach Integrated audits Common documentation system with common structure of routines	Customer satisfaction Reduction in the number of incidents

systems that can be integrated in a greater way. From the feedback received it was deduced that the most easily integrable requirements were those related to documentation management (A, B, D, E); monitoring, measurement and internal audits (A, B, E); management responsibility and commitment (B, E) and human resources competence, training and awareness (A, D). Case D pointed out that the new IMS facilitated the process for providing resources and Case A stated that the integration had helped to define corrective and preventive actions applicable to the entire service life cycle.

From the second column of Table 11, we see that the major advantages of the IMS collected in the case organizations span different areas of organizational management. Three organizations (B, D, E) considered process improvement as one of the strengths of the integration initiative, by the establishment of a set of managed and repeatable procedures and a common documentation system. Another benefit obtained was the definition of a useful system to engage, get the commitment and keep satisfied all the stakeholder interests (A, B, D). Cases A and C affirmed that the organizational efficiency and profitability had notably increased and the use of resources had gradually improved tending to optimal. Case E also points out that, from now on, the integrated audits will cover both ISO 9001 and ISO/IEC 20000-1 requirements.

The right-most column of Table 11 aims to identify information on the impact of the integration initiative on IT service quality in the interviewed organizations. When asked how the new IMS impacted the various areas of IT service quality, the interviewees uniformly responded that the customers were more satisfied. Other aspects affected were the stability and quality of services and reduction in the number of incidents (A, D, E), the facilitation of growth and certification of the organization (A, B, C) and better alignment of people and information (B, D).

6.3. Lessons learned

Regarding the remarks related to the application of the guide to support the implementation of the integrated ITSMS in the five service companies, we could point out that:

- These companies were unaware of the similarity between the structure and the certification process of both ISO 9001 and ISO/IEC 20000-1 standards. Some employees knew ITIL but above all, they knew the existence of its professional certifications. The ISO/IEC 20000-1 standard seemed very complex and out of reach to them. These companies required external intervention and consultancy to support process development and improvement, issues that they generally unknown and considered utopian and distant.
- These companies were fully devoted to their productive work and to solve their day-to-day problems. They are often unable and unwilling to devote time and efforts to define and deploy new processes or assets. Some of these companies do not have a quality department, unlike larger organizations, which is dedicated to these tasks. In small organizations, personnel are more oriented to service provision or management instead of establishing new working practices.
- Service companies not only need to know what to do in order to improve their services, but also they need to have specific procedures describing in detail the work they have to perform, with a clear set of best practices and a set of assets that will help to carry them out. These procedures should be simple and applicable to the types of services that they normally provide.

The valuation of this initiative is totally positive. As key strengths for its success it is worth highlighting:

- The active participation, motivation and consciousness of all the participant companies. A representative in each company (the IT manager) was selected to channel the needs and requirements of his/her company and raise them to the periodical monitoring meetings.
- The willingness to share the knowledge with the authors of the guide. The comments and experience gathered from the guide application in

these companies have been very useful to revise some sections in order to improve the readability and comprehension of all the proposed actions.

- The establishment of a detailed plan and its compliance with only some slight deviations. A very clear schedule with periodical monitoring in each participant company was defined. Without these reviews for the team to understand the next improvement actions to take, the cost of the implementation of the ISO/IEC 20000-1 standard would have been much higher.
- The selection of a collaborative work tool (Trello) to support the communication and file-sharing between all the representatives and the authors of the guide.

7. Conclusions and future work

This paper has presented the research performed to integrate the IT service management requirements into the quality management system of a service organization. After a systematic literature review of the all existing initiatives to integrate the ITSMS with the ISO 9001 QMS, and after a thorough analysis of all the relations between the requirements of the ISO/IEC 20000-1 and ISO 9001 management systems, the major contribution of the work is a guide to support the implementation of an IMS bringing together the requirements of both IT service and quality management systems. As it has been proved, because the ISO 9001 QMS and the ISO/IEC 20000-1 ITSMS follow a process approach and are based on the PDCA cycle, both management systems can be, after some efforts, connected and integrated.

The objective of this paper has been achieved: the demand of organizations for guidelines to support the integrated establishment of an ITSMS with the ISO 9001 QMS has been satisfied thanks to the guide developed during this research; and its validity has been evaluated in industry. This guide can be useful for IT service provider organizations to facilitate compatibility between management systems, goal alignment, ease in decision-making and the reduction of the resources required for their implementation, management and maintenance. While the first time an organization adopts a standard it has to make important efforts to follow all the requirements it defines, from the implementation of the second standard onwards, the company can take big advantage of all the previous efforts made, the lessons learned and the good practices deployed before.

The valuation of the application of the guide in different service companies in our country is totally positive. The applicability of the guide in organizations from different sectors has been proved. From the feedback we have received from management, it seems that organizations are willing to bet on management system integration. However, they have traditionally found difficulties to achieve this goal, due to the lack of clear guidelines that support the integration of management systems. The main benefits the companies have raised from the guide application are: significant cost savings, increase of flexibility, efficiency and coherence.

This study has its limitations. Although the five cases were diverse, selecting cases from more different industries will provide stronger support for the definition of specific recommendations included in the guide. Further work is expected to be performed in order to improve the developed guide by considering the lessons learned from its application in more companies. To date, the guide has been refined based on the evaluation suggesting additional clarifications on the terms used by the standards that integrates. Future actions already planned include the development of new assets to support the application of the guide, the changes in some of the existing ones and the addition of some new good practices to certain processes and requirements.

Furthermore, the authors plan to continue the research to understand the benefits and feasibility to widen the scope of the provided IMS in order to align it with ISO/IEC 27001 and COBIT 5. The main goal of this next iteration is to analyze the relations between the IMS and the information security management requirements of the ISO/IEC

27001 standard and the best practices for the governance and management of enterprise IT defined by COBIT. As these two frameworks follow a process approach and are also based on the PDCA cycle, we intuitively think that the creation of synergies between the management systems they define and the integration of their organizational policies and operational controls is very viable.

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References

- [1] M.C. Valiente, E. García-Barriocanal, M.A. Sicilia, Applying an ontology approach to IT service management for business-IT integration, *Knowl.-Based Syst.* 28 (2012) 76–87.
- [2] B. McNaughton, P. Ray, L. Lewis, Designing an evaluation framework for IT service management, *Inf. Manag.* 47 (2010) 219–225.
- [3] T. Lucio-Nieto, R. Colomo-Palacios, P. Soto-Acosta, S. Popa, A. Amescua-Seco, Implementing an IT service information management framework: the case of COTEMAR, *Int. J. Inf. Manag.* 32 (2012) 589–594.
- [4] ISO 9001:2008, Quality Management Systems – Requirements, ISO (International Organization for Standardization), 2008.
- [5] ITIL®, Lifecycle Publication Suite – Books, United Kingdom's Cabinet Office, TSO (The Stationery Office), 2011.
- [6] ISO/IEC 20000-1:2011, Information Technology – Service Management – Part 1: Service Management System Requirements, ISO (International Organization for Standardization), 2011.
- [7] ISO/IEC 27001:2013, Information Technology – Security Techniques – Information Security Management Systems – Requirements, ISO (International Organization for Standardization), 2013.
- [8] COBIT 5, Information Systems Audit and Control Association (ISACA), 2012.
- [9] Statement on Auditing Standards (SAS) No. 70 Service Organizations, American Institute of Certified Public Accountants (AICPA), 1992.
- [10] S. Karapetrovic, Strategies for the integration of management systems and standards, *TQM Mag.* 14 (1) (2002) 61–67.
- [11] M. Asif, O.A.M. Fisscher, E.J. de Bruijn, M. Pagell, Integration of management systems: a methodology for operational excellence and strategic flexibility, *Oper. Manag. Res.* 3 (2002) 3–4.
- [12] S. Abrahamsson, R. Isaksson, J. Hansson, Integrated Management Systems: advantages, problems and possibilities, Proceedings of the 13th Toulon–Verona Conference: Organizational Excellence in Service 2010, 2–4 September 2010, Coimbra, Portugal, 2010.
- [13] R.B. Pojasek, Is your integrated management system really integrated? *Environ. Qual. Manag.* 16 (2) (2006) 89–97.
- [14] C. Pardo, F.J. Pino, F. García, M. Piattini, M.T. Baldassarre, An ontology for the harmonization of multiple standards and models, *Comput. Stand. Interfaces* 34 (2012) 48–59.
- [15] Z. Micić, M. Micić, M. Blagojević, ICT innovations at the platform of standardisation for knowledge quality in PDCA, *Comput. Stand. Interfaces* 36 (1) (2014) 231–243.
- [16] F.J. Domínguez-Mayo, M.J. Escalona, M. Mejías, M. Ross, G. Staples, A quality management based on the Quality Model life cycle, *Comput. Stand. Interfaces* 34 (2012) 396–412.
- [17] S. Karapetrovic, J. Jonker, Integration of standardized management systems: searching for a recipe and ingredients, *Total Qual. Manag. Bus. Excell.* 14 (4) (2003) 451–459.
- [18] A. Griffith, K. Bhutto, Improving environmental performance through integrated management systems (IMS) in the UK, *Manag. Environ. Qual. Int. J.* 19 (5) (2008) 565–578.
- [19] M. Bernardo, M. Casadesus, S. Karapetrovic, I. Heras, How integrated are environmental, quality and other standardized management systems: an empirical study, *J. Clean. Prod.* 17 (8) (2009) 742–750.
- [20] I.A. Aboulmaga, Integrating quality and environmental management as competitive business strategy for 21st century, *Environ. Manag. Health* 9 (2) (1998) 65–71.
- [21] S. Karapetrovic, W. Willborn, Integration of quality and environmental management systems, *TQM Mag.* 10 (3) (1998) 204–213.
- [22] A. Labodová, Implementing integrated management systems using a risk analysis based approach, *J. Clean. Prod.* 12 (2004) 571–580.
- [23] M. Asif, E.J. de Bruijn, O.A.M. Fisscher, Corporate motivation for integrated management system implementation: why do firms engage in integration of management systems: a literature review & research agenda, 16th Annual High Technology Small Firms Conference, HTSF 2008, 21–23 May 2008, Enschede, The Netherlands, 2008.
- [24] D. Rajkovic, M. Aleksic, Corporate motives on implementation of integrated management system (IMS), *Int. J. Qual. Res.* 3 (2009) 3.
- [25] J. Fresner, G. Engelhardt, Experiences with integrated management systems for two small companies in Austria, *J. Clean. Prod.* 12 (2004) 623–631.
- [26] S.X. Zeng, J.J. Shib, G.X. Lou, A synergetic model for implementing an integrated management system: an empirical study in China, *J. Clean. Prod.* 15 (18) (2007) 1760–1767.
- [27] R. Salomone, Integrated management systems: experiences in Italian organizations, *J. Clean. Prod.* 16 (2008) 1786–1806.
- [28] S. Karapetrovic, M. Casadesus, Implementing environmental with other standardized management systems: scope, sequence, time and integration, *Journal of Cleaner Production* 17 (5) (2009) 533–540.
- [29] ISO Guide 72:2001, Guidelines for the Justification and Development of Management System Standards, ISO (International Organization for Standardization), 2008.
- [30] AS/NZS 4581:1999, Management System Integration – Guidance to Business, Government and Community Organizations, AS/NZS, 1999.
- [31] UNE 66177, Sistemas de gestión – Guía para la integración de los sistemas de gestión, AENOR, 2005.
- [32] PAS 99, Specification of Common Management System Requirements as a Framework for Integration, BSI (British Standards Institution), 2006.
- [33] The Integrated Use of Management System Standards, ISO (International Organization for Standardization), 2008.
- [34] B. Kitchenham, Guidelines for performing systematic literature reviews in software engineering version 2.3, Technical Report EBSE-2007-01, Software Engineering Group, School of Computer Science and Mathematics, Keele University, and Department of Computer Science, University of Durham, 2007.
- [35] B.A. Kitchenham, S. Lawrence Pfleger, L.M. Pickard, P.W. Jones, D.C. Hoaglin, K. El Emam, J. Rosenberg, Preliminary guidelines for empirical research in software engineering, *IEEE Trans. Softw. Eng.* 28 (8) (2002) 721–734.
- [36] J. Biolchini, P. Gomes, A.C. Cruz, G. Horta, Systematic review in software engineering, systems engineering and computer science department, COPPE/UFRJ, Technical Report RT-ES679/05, Rio de Janeiro, Brasil, 2005.
- [37] M. Djapic, L. Lukic, Integrated management systems – requirement of contemporary business practices, *Mech. Transp. Commun.* 3 (2008).
- [38] L. Novák, Integrated information management systems, Proceedings of the Security and Protection of Information Conference 2005, 3–5 May 2005, Brno, Czech Republic, 2005.
- [39] C.-H. Wang, T. Dwen-Ren, Integrated installing ISO 9000 and ISO 27000 management systems on an organization, 43rd Annual 2009 International Carnahan Conference on Security Technology, October 5–8 2009, pp. 265–267.
- [40] V.D. Majstorovic, V. Marinkovic, The development of business standardization and integrated management systems, *J. Med. Biochem.* 30 (2011) 334–345.
- [41] D. Cruzes, M. Mendonça, V. Basili, F. Shull, M. Jino, Extracting information from experimental software engineering papers, Proceedings of the XXVI International Conference of the Chilean Society of Computer Science (SCCC 2007), 2007, pp. 105–114.
- [42] ISO/IEC 90003:2004, Software Engineering – Guidelines for the Application of ISO 9001:2000 to Computer Software, ISO (International Organization for Standardization), 2004.
- [43] ISO/IEC TR 90005:2008, Systems Engineering – Guidelines for the Application of ISO 9001 to System Life Cycle Processes, ISO (International Organization for Standardization), 2008.
- [44] ISO/IEC NP 90006, Information Technology – Guidelines for the Application of ISO 9001:2000 to IT Service Management, ISO (International Organization for Standardization), 2008.
- [45] European Commission, in: European Commission (Ed.), Definition of Micro, Small and Medium-Sized Enterprises, vol. 2010, 2003.
- [46] A.-K. Jonsson Kvist, B. Klefsjö, Which service quality dimensions are important in inbound tourism?: a case study in a peripheral location, *Manag. Serv. Qual.* 16 (5) (2006) 520–537.
- [47] A. Zehrer, Service experience and service design: concepts and application in tourism SMEs, *Manag. Serv. Qual.* 19 (3) (2009) 332–349.

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